Memorandum: Groundwater Pathway Assessement at OSM and TZW Monitoring

Oregon Steel Mills
Portland, Oregon

Prepared by:

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RETEC Project Number: STRE1-18713-201

Prepared for:

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July 21, 2006

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MEMORANDUM

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TO: William Locke, Integral
Matt McClincey, OR DEQ
FROM: Linda Baker, Merv Coover
DATE: July 20, 2006

CLIENT: Oregon Steel Mills
TASK: STRE-18713-201
RE: Groundwater Pathway Assessment at OSM and TZW Monitoring

Oregon Steel Mills, Inc. (OSM) understands that DEQ has tentatively identified OSM for collection of transition zone water (TZW) data as part of Round 3A of the Portland Harbor RI. This memorandum summarizes groundwater Source Control Evaluation work OSM has performed and reported to DEQ (RETEC 2006a and RETEC 2006b) in support of OSM's contention that:

1. the groundwater migration pathways from upland areas to the Lower Willamette River are understood
2. the network of monitoring wells installed along OSM's river shoreline (i.e., beach wells) provide TZW-equivalent data
3. additional TZW sampling will not improve knowledge regarding the groundwater pathway at OSM

The objective of TZW sampling as described in the 2005 Round 2 Groundwater Pathway Assessment Sampling and Analysis Plan (Integral, 2005) is:

> *"to collect and analyze samples of transition zone water to quantify concentrations of groundwater-related chemicals of interest (COIs) in areas of plume discharge identified during the groundwater discharge mapping field effort."*

The sampling and analysis plan further states that:

> *"Groundwater discharge mapping and transition zone water sampling may also be performed at the Oregon Steel Mills and Premier Edible Oils sites under Round 3 of the RI/FS, depending on the findings from shoreline groundwater investigations planned for 2005 at these two sites. Specifically, if the planned upland investigations at these sites either 1) show evidence supporting the existence of a complete pathway to the river or 2) are not finished before the completion of Round 3 scoping, groundwater discharge mapping and transition zone water sampling at one or both of these sites may be identified as a Round 3 data gap."*

As summarized in this memorandum and discussed in the reports referenced above, OSM has completed upland groundwater SCE work and believes that groundwater quality in beach wells fulfills EPA objectives for TZW sampling for purposes of making pathway determinations and providing data for future risk evaluations.

Scope of SCE Work in Relation to TZW

The SCE work performed at OSM was designed, in part, to refine the conceptual site model and confirm whether:

- A complete transport pathway exists where migration of hydrocarbons from the former Ramsey Lakes Sump (former sump) source area discharge to the Willamette River at concentrations that present unacceptable risk.
- A complete transport pathway exists where migration of metals from upland areas discharge to the Willamette River at concentrations that present unacceptable risk.

The SCE scope of work included:

- Sampling of soil and groundwater from 6 geoprobe borings in the hydrocarbon source area (the former sump), extending to the underlying aquitard.
- Installation of 3 upland groundwater monitoring wells and 7 beach wells located just upland of the mean high water mark.
- Slug testing in 10 monitoring wells and laboratory testing of aquitard vertical permeability at 6 borehole locations.
- Sampling and analysis of groundwater from 23 wells for TPH, EPH/VPH, VOC, SVOC, and 11 metals[1] during September and December 2005.
- Sampling and analysis of groundwater from 12 wells for geochemical parameters[2] in December 2005.

The attached Figure 1 shows groundwater sampling locations. The beach well installation is of particular interest in relation to EPA TZW sampling objectives.

Hydrogeology

The SCE report confirmed existing information on groundwater flow and refined site knowledge of the underlying aquitard. Applicable hydrogeologic information is provided in Attachment A. In summary:

- The upper water bearing unit is a silty, fine sand encountered at depth of 4 to 20 feet below ground surface (bgs; 30 to 14 feet NGVD29) and extending to the underlying aquitard at depths of 20 to 35 feet bgs (10 to -5 feet NGVD29).

[1] TPH = total petroleum hydrocarbons; EPH/VPH = extractable petroleum hydrocarbons/volatile petroleum hydrocarbons; VOC = volatile organic compounds; SVOC = semivolatile organic compounds; metals= arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, and zinc.

[2] Sodium, potassium, calcium, magnesium, iron, nitrate, nitrite, ammonia, sulfate, alkalinity, sulfide, total organic carbon.

- The sandy silt to silty clay aquitard is continuous beneath the site and ranges in thickness from approximately 30 to 70 feet; vertical permeabilities are low (2.6×10^{-6} to 6.7×10^{-8} cm/sec).
- Groundwater flow is towards the river, with slight variations in direction in more upland areas.
- Beach wells intercept the water table at elevations of approximately 4 to5 feet NGVD29 (the approximate Willamette River mean low water elevation) and extend downward to elevations of -3, -5, or -11 feet NGVD29, depending on the well. Substantial vertical mixing is not expected due to the presence of silt layers in the upper sand.

Contaminated groundwater beneath the OSM upland is located in the shallow water-bearing zone above the aquitard. The beach wells intercept this upland shallow groundwater zone. Depending on river stage, beach wells are located very near or at the river's edge and groundwater in the beach wells discharges to the river within very short distances. Therefore, water collected from the beach wells would identify any complete transport pathways from the upland portion of the shallow aquifer and would be representative of concentrations in the TZW.

Migration of Hydrocarbons

The SCE work defined the extent of the hydrocarbon plume and showed that hydrocarbons in upland groundwater do not discharge to the Lower Willamette River at concentrations above screening levels. Figures and other supporting information for the following observations are provided in Attachment B.

- Petroleum hydrocarbons above the screening level are only found around and immediately downgradient of the former Ramsey Lakes sumps. Concentrations decrease in the downgradient direction.
- VOCs, PAHs and other SVOCs concentrations in OSM beach groundwater/TZW are below JSCS screening levels for protection of humans consuming fish and for protection of ecological receptors. Concentrations of these constituents are below drinking water standards with the exception of acenaphthene during one of the two sampling rounds (1.6 times the screening value).
- Qualitative investigations of organics in beach well/TZW samples reveal that the contribution of petroleum hydrocarbons to the standard NWTPH-Dx analysis is very small and that organic acids are responsible for the observed chromatographic signature.

As concentrations of petroleum hydrocarbons in beach wells are below screening levels, the hydrocarbon migration with groundwater at OSM does not form a complete transport pathway and does not present a risk to receptors from exposure to petroleum hydrocarbons.

Migration of Metals

The SCE work evaluated metal concentrations and associated geochemical conditions across the OSM facility and in the beach groundwater/TZW. Figures showing the distribution of metals in groundwater are included in Attachment C.

- Arsenic, cadmium, lead, nickel and manganese concentrations exceeded JSCS screening levels in beach groundwater/TZW. The differential between the lowest JSCS screening levels and beach groundwater/TZW for cadmium, lead and nickel are slight. The only significant exceedances were for arsenic and manganese.
- In general, the concentrations of metals in the beach groundwater/TZW, including those for arsenic and manganese, are consistent with TZW concentrations observed at the 9 sites evaluated thus far in EPA's Portland Harbor groundwater pathway assessment program (see Attachment C).
- Concentrations of arsenic are similar to site background conditions at OSM.
- Concentrations of manganese decrease by up to an order of magnitude between the upland area with the highest concentration and the beach groundwater/TZW. Geochemical testing has shown that the presence of manganese is largely controlled by localized geochemistry (See Attachment C). This is an important finding as it suggests that, in general, the metal content of TZW must be interpreted in the context of local geochemical conditions.
- With the exception of arsenic, river surface water concentrations are below screening levels and the surface water arsenic concentrations observed off OSM are comparable to upstream concentrations.

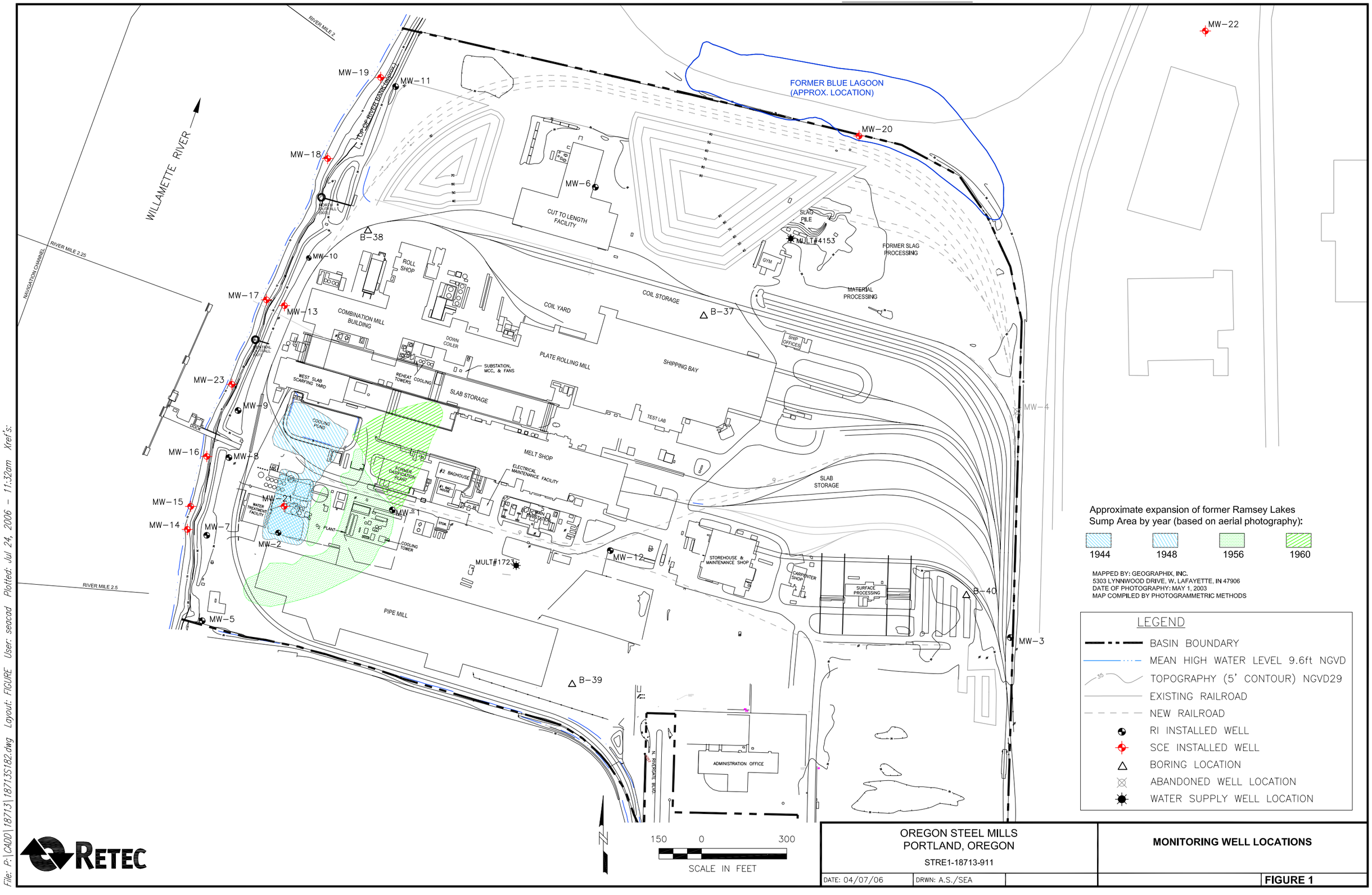
Metal concentrations in beach groundwater/TZW that exceed JSCS screening levels are consistent with concentrations measured in other TZW discharging to the Willamette River in Portland Harbor. Given the concentrations detected and JSCS screening levels, the transport pathway may be complete for selected metals (arsenic and manganese), as it may be for much of Portland Harbor. The Lower Willamette Group (LWG) is in the process of evaluating risks and background conditions associated with this pathway. The beach groundwater/TZW at OSM will be reviewed in context of risk and background as this work is completed.

Conclusion

OSM believes that groundwater in the beach wells at OSM is representative of, if not equivalent to, TZW water. The beach wells are screened across groundwater horizons where upland impacted groundwater migrates immediately prior to discharge to the river.

For petroleum hydrocarbons, the groundwater transport pathway is not complete and presents no risk to the river.

For selected metals, the groundwater transport pathway may be complete as concentrations in beach groundwater/TZW samples exceed screening level values. OSM acknowledges these findings and believes that the existing beach well data is sufficient to inform risk evaluations conducted as part of the Portland Harbor RI. OSM has fulfilled the objectives of TZW sampling and believes sufficient data exists to proceed with the risk assessment. Additional TZW sampling at OSM will not further the objective of establishing pathways from upland sources and defining the concentrations of groundwater contaminants being discharged to the river.



Approximate expansion of former Ramsey Lakes Sump Area by year (based on aerial photography):

1944 1948 1956 1960

MAPPED BY: GEOGRAPHIX, INC.
5303 LYNNWOOD DRIVE, W. LAFAYETTE, IN 47906
DATE OF PHOTOGRAPHY: MAY 1, 2003
MAP COMPILED BY PHOTOGRAMMETRIC METHODS

LEGEND

- BASIN BOUNDARY
- MEAN HIGH WATER LEVEL 9.6ft NGVD
- TOPOGRAPHY (5' CONTOUR) NGVD29
- EXISTING RAILROAD
- NEW RAILROAD
- RI INSTALLED WELL
- SCE INSTALLED WELL
- BORING LOCATION
- ABANDONED WELL LOCATION
- WATER SUPPLY WELL LOCATION

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MONITORING WELL LOCATIONS

DATE: 04/07/06 | DRWN: A.S./SEA | **FIGURE 1**

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